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Pair Cascades and Deathlines in Offset Magnetic Dipole Fields

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We investigate electron-positron pair cascades in a dipole magnetic field whose axis is offset from the neutron star center. In such a field geometry, the polar cap is displaced from the neutron star symmetry axis and the field line radius of curvature is modified. Using the modified parallel electric field near the polar cap of an offset dipole, we simulate pair cascades to determine the pair deathlines and pair multiplicities as a function of the offset parameter. We find that the pair multiplicity can change dramatically with a modest offset, with a significant increase on one side of the polar cap. Lower pair deathlines allows a larger fraction of the pulsar population, that include old and millisecond pulsars, to produce cascades with high multiplicity.